

# Rhodora

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## CALLITRICHE IN THE NEW WORLD

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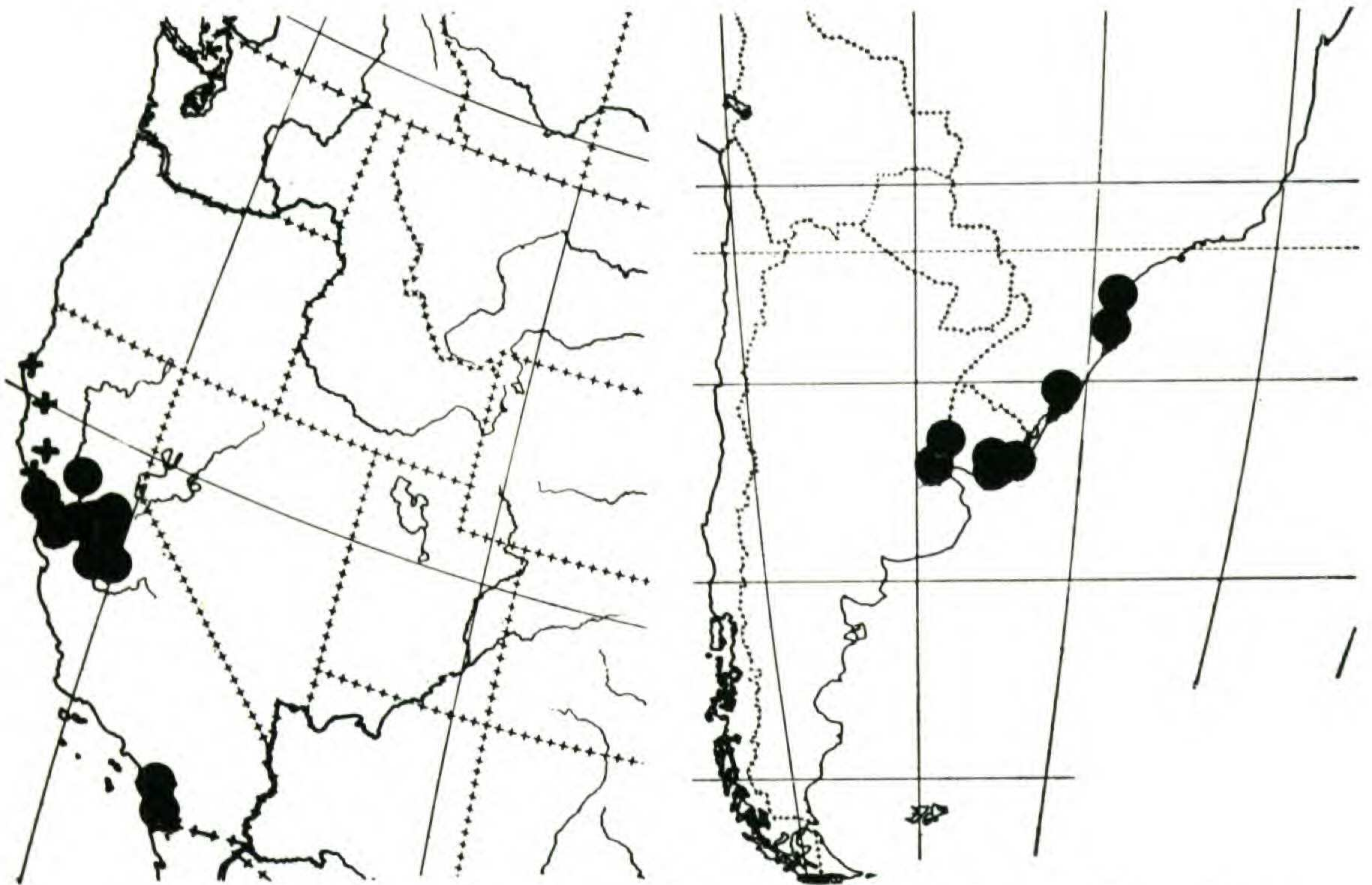
(Continued from page 194)

21. *C. longipedunculata* Morong, Bull. Torrey Club 18: 236. 1891. Fruit oblong, with nearly parallel or slightly rounded sides, 0.8–1.2 mm. wide. 1.0–1.4 mm. high, the length usually exceeding the width; surface of fruit olive-green when young, nearly black at maturity and shallowly and minutely but distinctly pitted; wing very narrow but of equal width around the whole fruit and slightly entering the lower sinus between mericarps (Fig. 21b), pale; commissural groove very wide and flat-bottomed; pedicel from about 0.5 mm. to 25 mm. in length; bracts present at flowering time but soon caducous; leaves often crowded toward the tips of the branches, less than 1 cm. long, the blade often wider than long and abruptly narrowed to a long margined periole.—Central and southern **California**—Sutter Co.: Marysville, March 21, 1905, *Heller 7561* (NY, MO). Marin Co.: Inverness Ridge, March 1, 1932, *Mason 6801* (UC). Calaveras Co.: three miles above Valley Spring, April 7, 1929, *Mason 5198* (UC); 6 miles south of Keystone on road to La Grange, March 16, 1932, *Hormay 705* (UC); six miles west of Valley Springs, April, 1930, *Mason 5546* (UC); two miles east of Valley Springs, April, 1930, *Mason 5545* (UC). Alameda Co.: Arroyo Mocho, March 6, 1932, *Mason 6807* (UC, GH); Arroyo Mocho, Mount Hamilton Range, alt. 2300 ft., April 14, 1935, *Sharsmith 1729* (UC). San Joaquin Co.: Peters, alt. 100–150 ft., March 20, 1928, *Stanford 835* (GH, US); ten miles east of Stockton, April, 1930, *Mason 5547* (UC). Stanislaus Co.: six miles west of Oakdale, April 7, 1929, *Mason 5171* (UC, GH); Warnerville, March 17, 1936, *Hoover 776* (UC). Merced Co.: four miles north of Merced on Snelling Road, March 16, 1932, *Hormay 706a* (UC, GH); fourteen miles east of Merced on Yosemite Road, Merced River, March 15, 1932, *Hormay 703* (UC, GH); Snelling Road, one and one-half miles north of Merced, March 16, 1932, *Hormay 707* (UC). San Diego Co.: Camp Kearney Mesa, March 2, 1937, *Purer 7106* (MO); mesa north of San Diego, May 10, 1903, *Abrams 3450* (UC, GH, NY, MO); Mesas, San Diego Co., April 25, 1884, *Orcutt* (NY—mixed with *C. marginata*, but TYPE).

The type is cited as “collected in 1884 by C. R. Orcutt, on mesas, San Diego, California.” Material bearing these data, at the New York Botanical Garden, is badly mixed; some plants have rotund leaves with peltate scales, floral bracts, and fruits



longer than wide, while others have spatulate leaves lacking scales, no floral bracts, and fruits wider than long. The first kind answers the description of *C. longipedunculata* and may be taken as type of that species, while the second kind is *C. marginata*.



19 (left). *C. trochlearis* (crosses). 21 (left). *C. longipedunculata* (dots).  
22 (right). *C. rimosa* (dots).

*C. longipedunculata* has often been confused with *C. marginata*, with which it has little in common except peduncled fruits. The ecological relationships of these two species have been discussed under *C. marginata*.

Individuals with fruits nearly sessile, or with some of them so, have been treated as *C. stenocarpa* Hegelm. Hegelmaier described the fruit of *C. stenocarpa* as being narrowed toward the base, precisely the character that distinguishes *C. verna* from the plant called *C. stenocarpa* by Morong and by Jepson. Hegelmaier cited two collections by Bolander, each of which consists of a sorry mixture of *C. verna*, *C. heterophylla* and *C. marginata* (one has also fragments of an aquatic *Ranunculus* for good measure). *C. verna* most closely fits the description of *C. stenocarpa*; *C. stenocarpa* accordingly becomes a synonym of *C. verna*.



22. **C. rimosa**, n. sp., fructibus rotundis vel angustioribus ad basem, 0.9–1.2 mm. latitudine, 0.9–1.3 mm. altitudine, crassitudine ad basem duplo maiore quam ad apicem; ala manifesta mericarpellorum apicem basemque circumstante; rima faciei fructuum brevi profunda; commissura in forma V, latissima profundissimaque.—Fruit 0.9–1.2 mm. wide, 0.9–1.3 mm. high, the height and width nearly or quite equal; fruit round or sometimes a little narrowed toward the base; a broad conspicuous wing extending around both upper and lower ends of each mericarp so that the groove on the face of the fruit is short but deep (Fig. 22b); fruit when seen in edge view (Figs. 22c, 22d) about twice as thick at base as at summit, the commissural groove V-shaped, very wide and deep (Fig. 22a); leaves on aquatic forms all of the lanceolate or ovate type, resembling those of Plate 1168, Figs. 2, 4, 5, 8, but sometimes larger and reaching 15 mm. in length and 6 mm. in width; stranded plants forming mats on the mud, with ovate leaves or spatulate leaves like those of Plate 1168, Fig. 1.—Coastal regions from southeastern Brazil to the mouth of Rio de la Plata.—**Brazil**: Parana, Jan. 2, 1904, *Dusen 3040* (US); St. Catharina, June 22, 1885, *Schwacke* (US); Rio Grande do Sul, São Leopoldo, August, 1941, *Leite 2804* (GH) and *614* (NY). **Uruguay**: Castillos, Dep. de Rocha, Nov. 6, 1931, *Herter 941* (CM); Florida, Dec. 22, 1936, *Rosengurt B 782* (CM); Santiago Vasquez, Dep. de Montevideo, Nov., 1924, *Herter 695a* (TYPE in GH, ISOTYPES in CM, MO, NY, UC, WIS). **Argentina**: Concepcion del Uruguay, Nov. 7, 1877, *Lorentz 851* (CM, GH); Hudson, Prov. Buenos Aires, Oct. 3, 1931, *Parodi 9923* (GH); San Isidro, Prov. Buenos Aires, Oct. 25, 1929, *Parodi 8973* (GH); Bosque de Punta Lara, Prov. Buenos Aires, Nov. 4, 1942, *Dawson 1148* (LP); Ribera del Rio de La Plata, Isla Santiago, Nov. 1, 1932, *Cabrera 2437* (LP); Rio Santiago, cerca de La Plata, prov. de Buenos Aires, Nov. 21, 1929, *Cabrera 918* (LP); Punta Lara, Prov. Buenos Aires, Nov. 11, 1940, *Dawson 993* (LP).

23. **C. stagnalis** Scop. emend. Kütz. *C. stagnalis* Scop. Fl. Carn. ed. 2; 251. 1772, *nomen ambiguum*; Kütz. in Reichenb. Pl. Crit. IX. 36–38, figs. 1184–1186. 1831; Reichenb. Icon. V. Tab. cxxix. fig. 4747. 1841; Hegelm. Monographie Gattung Callitriche 58. 1864; Hegelm. Verhandl. Bot. Ver. Brandenburg. 9: 26. 1867; Glück, Biol. und Morphol. Untersuch. ü. Wasser- und Sumpfgewächse 4: 260. 1924; Samuelsson, Fest. Carl Schröter 613. 1925; Hegi, Ill. Fl. Mitt.-Eur. 5, pt. 1: 196. 1924; Pearsall, Bot. Soc. & Exch. Club Br. Isles 10: 864. 1935; Glück, Süßwasser-Flora Mitteleuropas 15: 293. 1936; Fassett, Manual Aquatic Plants 241. 1940; Muenscher, Aquatic Pl. U. S. 260. 1944; Fernald in Gray's Manual, ed. 8: 973. 1950.—Fruit round or nearly so, 1.2–1.7 mm. wide and nearly or quite as high, the faces flat, shallowly pitted, light brown or very pale,<sup>1</sup> winged evenly all around; wing very narrow on young fruits (Figs. 23a, 23d), about as wide as 3 of the pits at maturity and sometimes erose (Fig. 23h), commonly running around the base and frequently around the summit of each mericarp so that the facial groove is short and deep (Fig. 23o); mericarp semicircular, with inner edge straight (Figs. 23a, 23d) or semilunar with the inner edge curved (Figs. 23c, 23h); styles 2–3.5 mm. long, on the mature fruit often breaking, or persistent and erect, or somewhat deflexed from the summit of the carpels (Fig. 23c) but not from between the mericarps (cf. Fig. 24g); commissural groove somewhat rounded, very wide and deep (Figs. 23f, 23g); foliage very variable.—Europe, and in North America from the St. Lawrence to the Potomac River, in northern Wisconsin, and in Washington and Oregon.

<sup>1</sup> When a mericarp is boiled in KOH and the pericarp stripped off and examined with a compound microscope, the reticulations appear almost colorless rather than dark brown as in other species.



This is almost certainly introduced into eastern North America. The first mention of its occurrence on this continent was in 1932,<sup>1</sup> unless the listing of *C. platycarpa* in Gray's Manual, 1848, with its reference to a large wing-margined fruit, may have been based on this species. The earliest collection in the eastern states appears to have been from New Jersey in 1891. It is at present very abundant in streams and springs in Lancaster Co., Pennsylvania, where it certainly would have been collected long ago if it were native.

From the far Northwest there is a collection from Oregon, without locality, made by Elihu Hall in 1871. This leads to speculation on the possibility of its being native in that region.

North American material is perhaps a little less variable than the European; this may signify that the forms are in part genetic in origin as well as ecological, and that only certain strains have been introduced. The commonest phase of the species is the typical robust aquatic, *C. stagnalis* f. *stagnalis*. Of the material examined by the present writer, about 50% of the European specimens are f. *stagnalis*, and 80% of the American specimens are this form. The writer has examined *C. stagnalis* in the vicinity of Ephrata, Lancaster Co., Pennsylvania, where it remains essentially uniform as f. *stagnalis* in a variety of aquatic habitats. In the shallow polluted water of Cocalico Creek directly below the Ephrata sewage plant, *C. stagnalis* is somewhat less luxuriant than in the pure cold springs at nearby Springville, but the plants themselves are quite similar in appearance. On the other hand, a single clone along the shore line may form a dense turf on the mud with stems partly creeping and partly erect to a height of nearly 10 cm. with leaves 3–4 mm. long, while as it extends into the water the stems elongate and have submersed and floating leaves twice the size of the terrestrial ones; such a plant is cited below under f. *caespitosa*.

The named variations in habit and leaf form are legion. The following key is derived in large part from the descriptions by Glück, 1924. No particular effort has been made to correlate all the names and determine strict priority. The forms are probably of ecological origin in large part, and are recognized here only to show something of the range of variation. Actually, a

<sup>1</sup> Svenson, *Rhodora* 34: 37–39, 1932, and Fernald, *ibid.* 39.



somewhat similar organization of ecological forms might be proposed for nearly or quite every species in the Sect. Callitriche.

a. Aquatic forms.

b. All leaves 3–7-nerved.

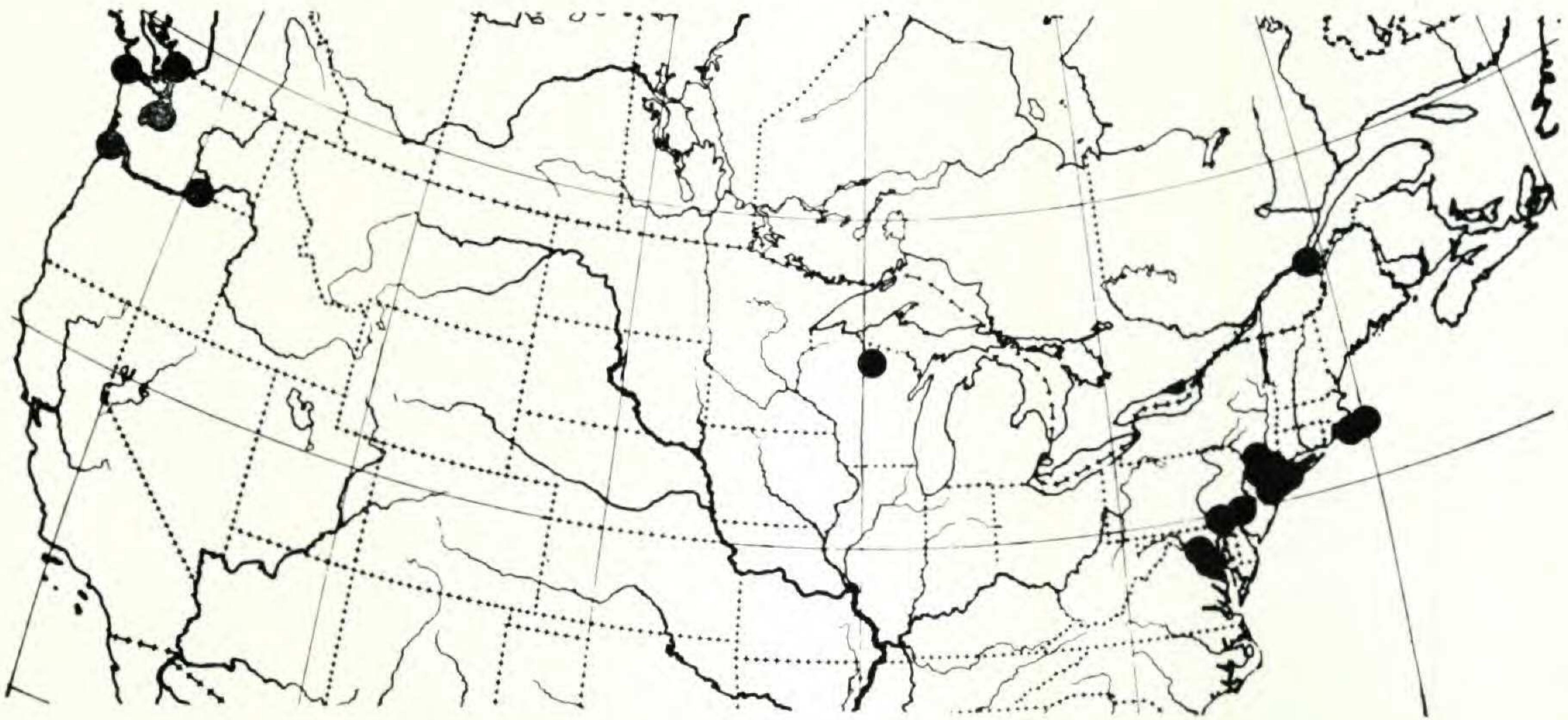
c. Leaves obovate.....f. *stagnalis*.

c. Leaves spatulate.....f. *spathulata*.

b. Some leaves linear and 1-nerved.

d. Broad leaves also present in a floating rosette.....f. *heterophylla*.

d. Broad leaves absent.....f. *submersa*.



23. *C. stagnalis* in the New World.

a. Terrestrial forms, rooting at most of the nodes and forming a close turf, but with tips of stems often erect.

e. Internodes very short; leaves 0.5–2.5 mm. wide.....f. *terrestris*.

e. Internodes about 1 cm. long; leaves 2–5 mm. side.....f. *caespitosa*.

***C. stagnalis* f. *stagnalis*.** *C. stagnalis* f. *vulgaris* (Kütz) Glück, Biol. und Morphol. Untersuch. ü. Wasser- und Sumpfgewächse 4: 265. 1924. *C. stagnalis*  $\alpha$  *vulgaris* Kütz. in Reichenb. Pl. Crit. IX. fig. 1184–86. 1831.—**Massachusetts:** Waquoit, Barnstable Co., Aug. 2, 1911, *Pennell 3381* (GH); Falmouth, Barnstable Co., Oct. 28, 1928, *Fernald & Svenson 466* (GH, NY, MO, UC, US, WIS, US, CM). **New York:** Cold Spring Harbor, Long Island, 1919, *Banker 2962* (NY); Valley Stream, Long Island, April 5, 1931, *Svenson 4451* (GH); Islip, Long Island, April 5, 1931, *Svenson 4552* (GH); Richmond, Staten Island, June 7, 1931, *Svenson 4493* (GH); Constitution Island, Putnam Co., Aug. 23, 1936, *Muenscher & Curtis 5745* (GH); Vails Gate, Orange Co., June 14, 1938, *House 25672* (GH, NY). **New Jersey:** Carlton Hill, Bergen Co., July 11, 1891, *Nash* (NY); Preakness, Passaic Cr., May 31, 1931, *Svenson 4478* (GH). **Pennsylvania:** Indian River, West Philadelphia, May 17, 1923, *Meredith* (GH); West Philadelphia, Nov. 24, 1929, *Svenson 3486* (GH); Landsdowne, Delaware Co., June 27, 1932, *Hermann 3325* (US); Germantown, Philadelphia Co., May 13, 1936, *Fogg 10294* (GH); Ephrata, Lancaster Co., July 19, 1948, *Fassett 27856* (WIS); Springville, near Ephrata, Aug. 22, 1948, *Blum* (WIS). **Maryland:** Branchville, Prince Georges Co., May 7, 1927, *Uhler* (WIS); National Agric. Research Area, Beltsville, April 14, 1941, *Jensen* (WIS);



Beltsville, Prince Georges Co., June 10, 1943, *Hermann 10827* (NY); Beltsville, May 31, 1946, *Hotchkiss 7073* (US); Plummers Island, Cabin John, June 7, 1947, *Killip 36833* (US); Lock 11, C. & O. Canal, Montgomery Co., May 16, 1942, *Killip 36567* (GH, MO, US). **Wisconsin:** Rhinelander, Oneida Co., Aug. 25, 1925, *Davis* (WIS). **Washington:** Kennewick, Benton Co., Aug. 1926, *Jones 369* (WIS). **Oregon:** without locality, 1871, *Elihu Hall 460* (CM); John Day, Clatsop Co., Aug. 10, 1902, *Sheldon 11215* (GH, NY, MO, US, CM). **British Columbia:** New Westminster, June 10, 1916, *Henry 9068* (GH).

This form includes the most luxuriantly growing plants and largest foliage in the species, and probably in the entire genus *Callitriche*. Some leaves reach 8 mm. in width and 2.5 cm. in length.

**C. stagnalis** f. **heterophylla** Glück, l. c. **Massachusetts:** Falmouth, Barnstable Co., Oct. 28, 1928, *Fernald & Svenson 953* (GH).

**C. stagnalis** f. **terrestris** Glück, l. c., 266. *C. stagnalis* var. *serpyllifolia* Lönnr. Obs. Crit. Pl. Suec. 16. 1854. **Quebec:** Anse St. Vallier, Bellechasse Co., Sept. 15, 1931, *Fernald 2530* (GH, US).

**C. stagnalis** f. **caespitosa** Glück, l. c., 268. **Massachusetts:** Falmouth, Barnstable Co., Oct. 28, 1928, *Fernald & Svenson 954* (GH, NY, NEBC). **Pennsylvania:** West Philadelphia, Nov. 24, 1929, *Svenson 3486* (MO—mixed with f. *stagnalis*); Ephrata, Lancaster Co., July 19, 1948, *Fassett 27853* (WIS—this is the terrestrial portion of the plant; the aquatic portion is f. *stagnalis*). **Maryland:** mouth of the Sligo, May 17, 1915, *Standley 11584* (US). **Washington:** Green Lake, Seattle, July 28, 1933, *Thompson 9612* (NY). **British Columbia:** New Westminster, June 10, 1916, *Henry 9069* (GH—same locality as *Henry 9068* which is f. *stagnalis*).

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PLATE 1175

(Numbers same as in keys and descriptions)

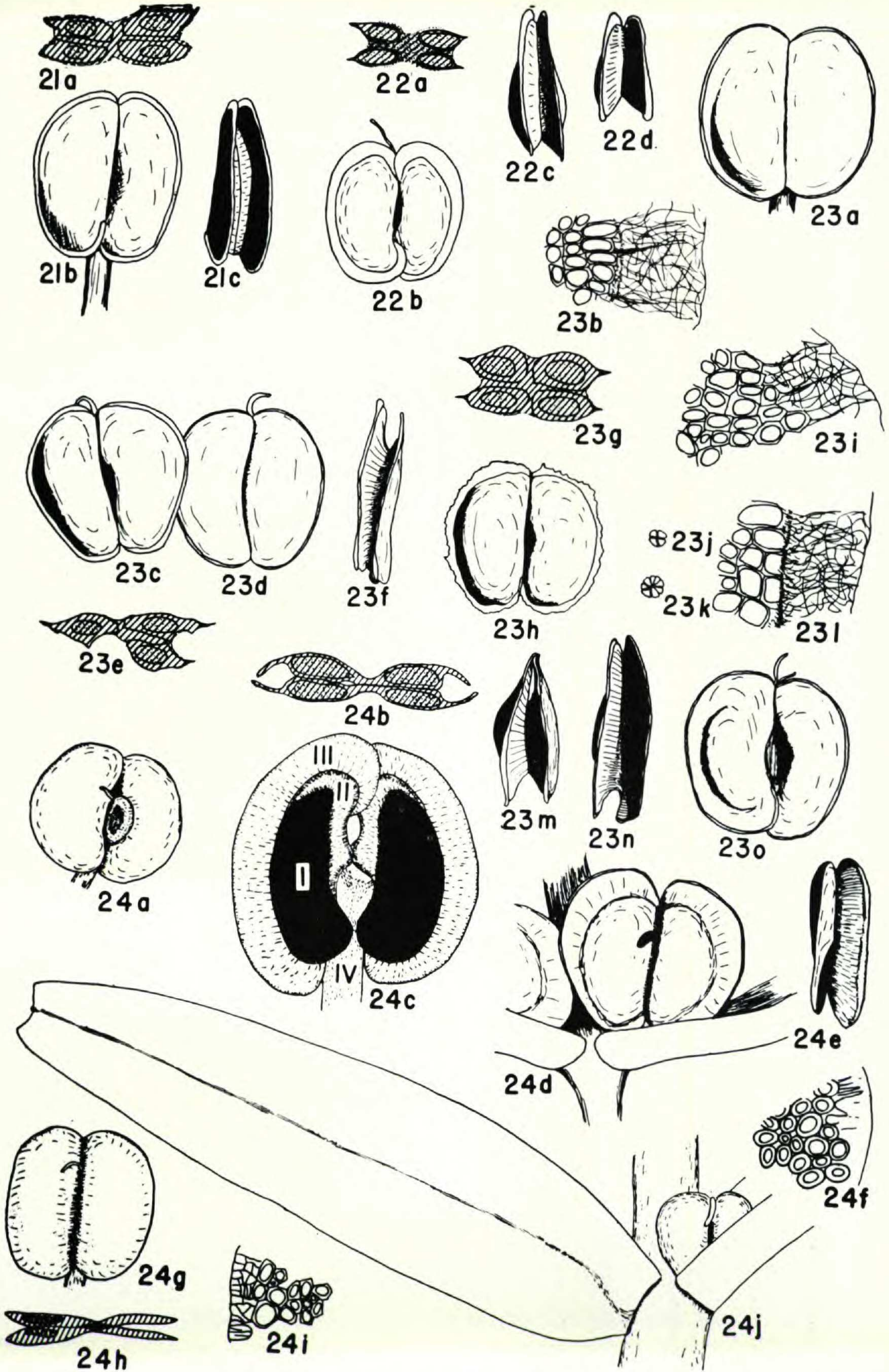
21. *C. longipedunculata*. 21a. Cross-section of fruit,  $\times 30$ . California, *Stanford 835* (US). 21b. Face of fruit,  $\times 30$ . Same collection. 21c. Edge of fruit,  $\times 30$ . Same collection.

22. *C. rimosa*. 22a. Cross-section of fruit,  $\times 30$ . Uruguay, *Herter 695a* (GH). 22b. Face of fruit,  $\times 30$ . Same collection. 22c. Edge view of fruit,  $\times 30$ . Argentina, *Parodi 9561* (GH).

23. *C. stagnalis*. 23a. Face of young fruit,  $\times 30$ . Pennsylvania, *Meredith* (GH). 23b. Portion of wing and face of fruit,  $\times 187.5$ . Same collection. 23c. Face of fruit,  $\times 30$ . France, *Cintract* in 1885 (US). 23d. Face of fruit,  $\times 30$ . Same collection. 23e. Cross-section of fruit,  $\times 30$ . Same collection. 23f. Edge view of fruit,  $\times 30$ . Same collection. 23g. Cross-section of fruit,  $\times 30$ . Massachusetts, *Fernald & Svenson 952* (GH). 23h. Face of fruit,  $\times 30$ . Same collection. 23i. Portion of wing and face of fruit,  $\times 187.5$ . Same collection. 23j. Peltate scale from leaf,  $\times 187.5$ . Pennsylvania, *Blum* (WIS). 23k. Peltate scale from leaf,  $\times 187.5$ . Same collection. 23l. Portion of wing and face of fruit,  $\times 30$ . Same collection. 23m. Edge view of fruit,  $\times 30$ . Massachusetts, *Fernald & Svenson 952* (GH). 23n. Edge view of fruit,  $\times 30$ . Pennsylvania, *Blum* (WIS). 23o. Face of fruit,  $\times 30$ . Same collection.

24. *C. hermaphroditica*. 24a. Face of young fruit, with an aborted mericarp,  $\times 30$ . Wyoming, *Payson & Payson 2933* (NY). 24b. Cross-section of fruit,  $\times 30$ . Greenland, *Porsild* (US). 24c. Face of fruit, from boiled specimen, showing seeds (I), partly surrounded by inflated part of mericarps (II), false wing formed by uninflated parts of mericarps (III), and pedicel (IV),  $\times 30$ . Same collection. 24d. Face of fruit, parts of stem and leaves,  $\times 30$ . New York, *Fernald, Wiegand & Eames 14371* (GH). 24e. Edge view of fruit,  $\times 30$ . Same collection. 24f. Portion of wing and face of fruit,  $\times 187.5$ . Same collection. 24g. Face of young fruit,  $\times 30$ . Nebraska, *Kiener 23769* (WIS). 24h. Cross-section of young fruit,  $\times 30$ . Same collection. 24i. Portion of wing and face of fruit,  $\times 187.5$ . Same collection. 24j. Leaf, young fruit and part of stem,  $\times 30$ . Quebec, *Victorin & Rolland 29082* (GH).





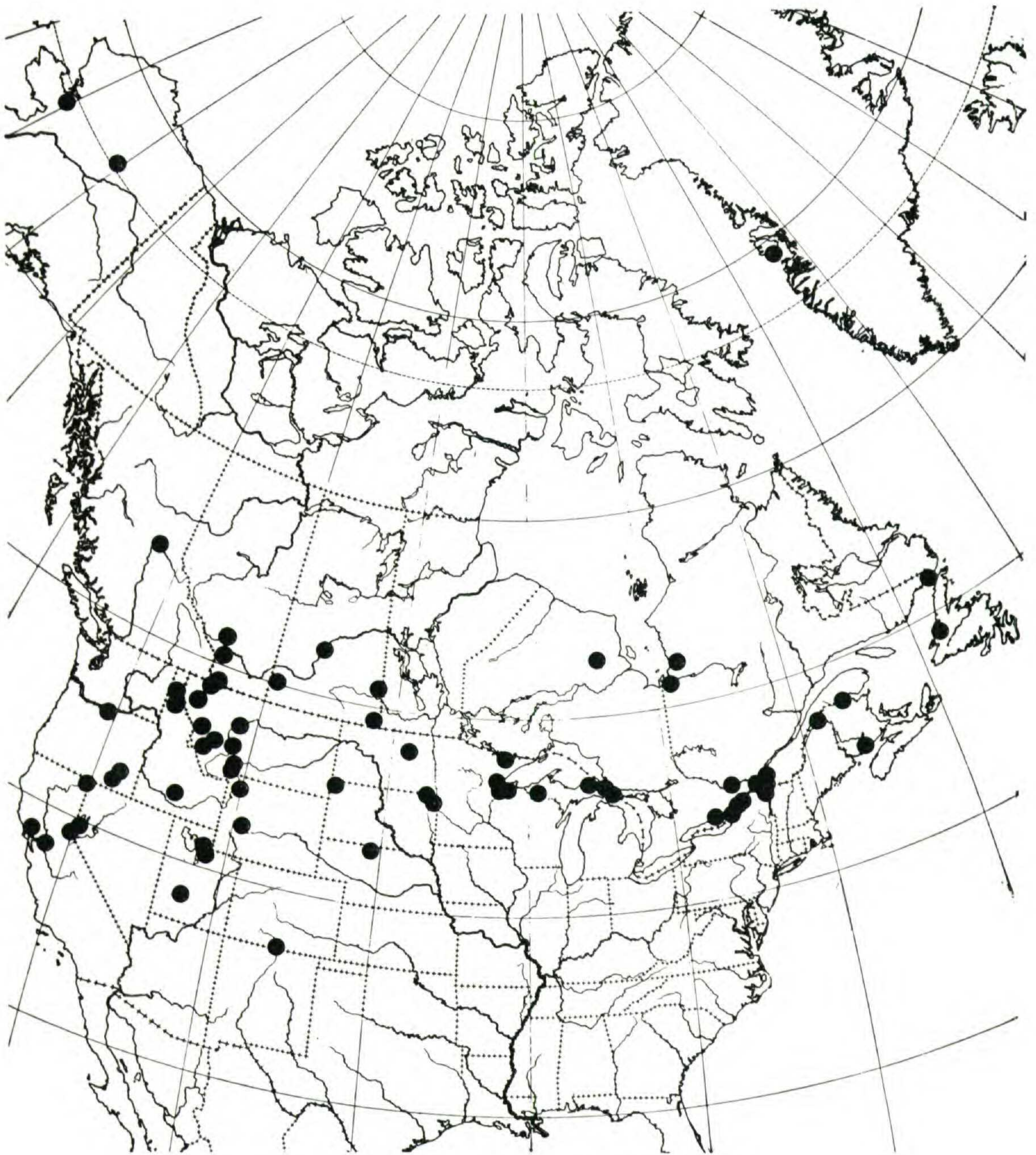
CALLITRICHE. 21. *C. LONGIPELUNCULATA*. 22. *C. RIMOSA*. 23. *C. STAGNALIS*. 24. *C. HERMAPHRODITICA*.



*C. stagnalis* f. *submersa* Glück, l. c., 260, and f. *spathulata* Glück, l. c., 264, have not been seen from the Western Hemisphere.

24. **C. hermaphroditica** L. Cent. I. Pl. no. 90. Feb. 1755; Schinz & Thellung, Vierteljahrs. Nat. Gesell. Zurich 53: 548. 1909; Fernald & Wiegand, Rhodora 25: 211. 1923; Victorin, Fl. Laurent. 217. 1935; Fassett, Man. Aquat. Pl. 241. 1940; Muenscher, Aquat. Pl. U. S. 260. 1944; Fernald in Gray's Manual, ed. 8. 973. 1950. *C. palustris* var. *bifida* L. Sp. Pl. 2. 969. 1753 (perhaps). *C. autumnalis* L. Fl. Suec. ed. 2: 2. Oct. 1755; Willd. Sp. Pl. ed. 4, 1: 29. 1798; Wahlenb. Fl. Lap. 2. 1812; DC. Prod. 3: 71. 1828; Hegelm. Monogr. Gattung Callitriche 61. 1864; Hegelm. Verhandl. Bot. Brandenburg 9: 35. 1867; Robinson & Fernald in Gray's Man. ed. 7: 550. 1908; Henry, Fl. South. B. C. 200. 1915; Rydb. Fl. Rocky Mts. 548. 1917; Rydb. Fl. Prairies & Plains 522. 1932; Samuelsson, Festschrift Carl Schröter 610. 1925; Jepson, Fl. Calif. 2: 435. 1936; Peck, Man. Higher Pl. Ore. 466. 1941. *C. bifida* Morong, Mem. Torrey Club 5: 215. 1894; Britton & Brown, Ill. Fl. ed. 1, 2: 382. 1897; Coult. & Nels. Man. Rocky Mt. Bot. 312. 1909.—Fruit from 1–2.5 mm. wide, about as high as wide; surface of carpels obscurely and irregularly pitted; margins of carpels with a narrow wing (Fig. 24d), but the outer part of the carpel itself strongly compressed and wing-like (Fig. 24b); style sharply reflexed from between the mericarps (Figs. 24a, 24d, 24g, 24j), usually breaking and leaving the persistent base; floral bracts absent; leaves lance-linear, uniform (Fig. 24j), metallic green, narrowly white-margined, with bases distant or nearly in contact but not connected by a wing.—Europe; Greenland to Alaska, south to New Brunswick, Quebec, northern Vermont, northern New York and adjacent Ontario, Upper Peninsula of Michigan, northern Wisconsin, Minnesota and South Dakota, and in the mountains to Colorado, Utah, Nevada and California; of local occurrence eastward.—Relatively few of the many collections examined are cited below. **Greenland:** lakes at Kamavit, Nordfjord, Disco, Aug. 7, 1902, *Porsild* (US, GH); S. Disco, Godhavn, 69° 15' Lat. bor., Sept. 11, 1923, *Porsild* (US, GH, NY). **Labrador:** Blanc Sablon River, Straits of Belle Isle, Sept. 3, 1925, *Fernald, Wiegand & Long 28644* (GH). **Newfoundland:** Dead Lake, Bay of Islands, Aug. 25, 1897, *Waghorne* (MO, GH); East Brook, St. Barbe Bay, Aug. 29, 1925, *Wiegand & Hotchkiss 28643* (GH). **Quebec:** East Main River, east coast of Hudson Bay, 52° 15' N., Aug. 29, 1944, *Dutilly & Lepage 13508* (WIS, GH); Broadback River, Rupert Bay, James Bay, 51° N., 79° W., Sept. 4, 1946, *Dutilly & Lepage 16972* (WIS); Lake Temiscouata, Aug. 28, 1891, *M[acoun]* (NY); Hull, Sept. 8, 1917, *Rolland 6198* (US, MO, GH, NY); Longueuil, île Plate, Aug. 25, 1927, *Victorin & Rolland 29082* (US, GH); Isle-aux-Noix, Richelieu River, Aug. 13, 1918, *Victorin 8165* (US, GH). **New Brunswick:** tidal shores Restigouche River, Tide Head, Restigouche Co., Aug. 16, 1923, *Svenson & Fassett 2014* (GH); Rothsay, Aug. 4, 1877, *Fowler* (GH). **Vermont:** Kelleys Bay, Lake Champlain, Aug. 5, 1878, *Pringle* (GH, MO, CM, NY). **New York:** Ogdensburg, *Clinton* (GH); Alexandria Bay, Sept., 1863, *Clinton* (NY); Morristown, Aug. 15, 1914, *Phelps 703* (US, GH, NY); Waddington, St. Lawrence Co., Aug. 22, 1935, *House 22964* (GH, US, NY); Showshoe Bay, Jefferson Co., Aug. 31, 1931, *Muenscher & Maguire 2378* (MO, GH, UC); Guffin Bay, Point Salubrious, Jefferson Co., Aug. 27, 1922, *Fernald, Wiegand & Eames 14371* (GH). **Ontario:** Battersea, Aug. 30 or 31, 1904, *Fowler* (MO, US). **Michigan:** Sault Ste. Marie, Aug. 25, 1882,





24. *C. hermaphrodilica* in the New World.

*Morong* (NY, CM, GH); Pt. Detour, Sept. 21, 1875, *Gillman* (NY, MO); Tahquamanon River, Luce Co., Sept. 10, 1915, *Dodge 192* (NY); West Branch of Ontonagan River near Tenderfoot Lake, Gogebic Co., Aug. 27, 1931, *Hotchkiss & Koehler 4344* (US). **Wisconsin:** Marengo Lake, Bayfield Co., Sept., 1931, *Hotchkiss & Koehler 4359* (US, UC); Bark Bay, Bayfield Co., Aug. 10, 1945, *Thomson & Bjork* (wis); Brule, Douglas Co., Sept. 14, 1942, *Fassett 21990* (wis, GH). **Minnesota:** Fall Lake, Lake Co., Sept., 1921, *Kubichek 169* (US); Lake Comstock, 34 miles north of Duluth, Aug. 16, 1938, *Lakela 2729* (GH); Wheaton, Traverse Co., Sept., 1893, *Sheldon* (GH, US, wis). **North**



**Dakota:** Leeds, Benson Co., July 27, 1911, *Lunell* (US). **South Dakota:** Buffalo Lake, Marshall Co., Aug. 3, 1923, *Over 15463* (US); Dry House Creek, Harding Co., July 26, 1910, *Visher 143* (CM). **Nebraska:** fish hatchery pond, Valentine, Cherry Co., June 1, 1948, *Kiener 23769*—possibly introduced (WIS). **Saskatchewan:** Yorkton, July 7, 1906, *Macoun 72366* (NY, CM); Crane Lake, June 20, 1894, *Macoun 4962* (GH); Souris River, July 29, 1883, *Macoun* (US). **Alberta:** Cree (Mamawi) Creek, about 58° 29' N. to 58° 34' N., 110° 30' W., Wood Buffalo Park, Mackenzie Basin, Aug. 15, 1930, *Raup 2812* (GH, NY, UC); 13 miles south of Calgary, July 31, 1941, *Hitchcock & Martin 7832* (GH, MO, NY, UC). **Montana:** Townsend, July 15, 1895, *Shear 5252* (US, NY); Great Falls, Oct. 5, 1888, *Williams 772* (US); Georgetown Lake, Anaconda, Sept. 15, 1922, *Sperry 325* (US); Lake McDermott, Glacier National Park, Aug. 10, 1919, *Standley 17429* (US). **Wyoming:** Yellowstone Lake, Sept., 1885, *Tweedy* (US); Kendall, Sublette Co., Aug. 5, 1922, *Payson & Payson 2933* (GH, US, NY, UC, MO). **Colorado:** Rio Grande at Loma (probably Costilla Co.), 1873, *Wolf 987* (CM, US); Cottonwood Lakes, 8000 ft., Aug., 1886, *Harper* (CM). **Idaho:** Thompson Mountain, Coeur d'Alene Mountains, Aug. 27, 1895, *Leiberg 1604* (GH, US, MO); Camas Cr., Camas Co., *Davis 2806* (WIS). **Utah:** Big Cottonwood Canyon, Salt Lake Co., Aug. 21, 1905, *Garrett 1626* (NY); Brighton's, Sept., 1898, *Jones 6356* (MO, US). **Nevada:** Coon Creek Pass, Jarbridge Mountains, Elko Co., Aug. 10, 1943, *Maguire & Holmgren 22412* (GH, US, NY, UC); Copper Basin, Humboldt National Forest, Elko Co., Aug. 23, 1941, *Holmgren 1883* (NY, UC); Reno, Washoe Co., July 4, 1937, *Archer 5506* (NY). **Alaska:** Amchetka I., Unalaska, April 17, 1937, *Steenis 4643* (WIS); Seward Peninsula, Buckland River 26 miles above the delta, Sept. 7–10, 1926, *Porsild & Porsild 1598* (GH, US); Wiseman, Aug. 1–9, 1940, *Scamman 2276* (GH). **British Columbia:** Bonaparte River, June 23, 1889, *Macoun 8821* (CM); Prince George, July 31, 1941, *Weber 2583* (NY). **Oregon:** Dalles City, May 4, 1898, *Suksdorf 2746* (GH, MO, CM, US); Harney Valley, June 10, 1885, *Howell* (US, CM). **California:** Clementes, San Joaquin Co., May 3, 1928, *Mason 4445* (UC—TYPE of var. *bicarpellaris* Fenley, GH); Mt. Reservoir, Devil's Garden, Modoc Co., Aug. 22, 1935, *Wheeler 3904* (NY, GH); Kelseyville, May 13, 1929, *Blankinship* (MO). A sheet labelled Mobile, Alabama, March, 1888, *Mohr* (US) is certainly mislabelled.

The three Linnean names have been somewhat doubtful in application, because submersed individuals of the *Callitriche* group sometimes lack expanded leaves and may well have been confused with this species. According to Samuelsson, l. c., the plants of Loeselius and of von Haller, on which the name *C. palustris* var. *bifida* was based, and which are cited under *C. hermaphroditica* and under *C. autumnalis*, are both of the *Callitriche* group. Samuelsson therefore treated the three Linnean names as confused names, and took up *C. autumnalis* as emended by Wahlenberg, who gave what he considered to be the first unequivocal description. Unfortunately, Wahlenberg took up the more recent of the two specific names used by Linnaeus. It may be argued, then, that his interpretation of *C. autumnalis* L.



(Oct., 1755) served automatically as an interpretation of *C. hermaphroditica* L. (Feb., 1755), and validates the older name as well as the younger, since *C. autumnalis* and *C. hermaphroditica* are based on exactly the same references and so are synonymous. Certainly, *C. autumnalis* was a superfluous name when published, being a direct renaming of *C. hermaphroditica*.

But the assumption that both specific names were based on submersed forms of the Callitriche group is not wholly justified. To be sure, the treatment in the Species Plantarum was based on ecological forms alone. But in 1755 Linnaeus' student Juslenius described *C. hermaphroditica*, excluding *C. palustris* of the Species Plantarum and specifying "autumno florens." Later in the same year Linnaeus took the hint from his student and differentiated *C. verna* ("Majo & junio") and *C. autumnalis* ("Autumno florens"). Apparently he substituted the name *autumnalis* for *hermaphroditica* in an attempt to emphasize the seasonal difference between what we now take as the Sect. Callitriche and the Sect. Pseudocallitriche. *C. verna* could have been any one of a number of species, but *C. autumnalis* and *C. hermaphroditica* could have been only the late-flowering species now known by these names.

For many years after 1755 Linnaeus' name *C. autumnalis* was used, to the exclusion of the earlier *C. hermaphroditica* proposed by his student. In 1909 Schinz & Thellung pointed out that the longer epithet had priority. Rather than starting as a completely ambiguous name, *C. autumnalis* has acquired ambiguity during the intervening years, having been applied to various species by different authors (cf. Pearsall, Bot. Soc. & Exch. Club Br. Isles 10: 867. 1935). *C. hermaphroditica*, on the other hand, has been spared such misapplications, chiefly due to the fact that it has scarcely appeared in the literature from the time Linnaeus suppressed it in favor of *C. autumnalis* to its revival in 1909.

At first examination there would appear to be two types of fruit on this species. One is broad-winged and plump-sided (Fig. 24d), ranging from 1.2–2.5 mm. in width, while the other is nearly wingless and flat-sided (Fig. 24g), ranging from 1.0–1.5 mm. in width. These two types, however, are but two stages in development; the first is found on collections from early June to early September, while the latter is collected from August to



December (May, in California). Fig. 24g, then, which can scarcely be distinguished from the fruit of *C. hamulata*, is but an early stage in development. Large and fully matured fruits, on the other hand, are often quite similar to those of *C. stagnalis*, differing most conspicuously in their recurved styles.

The broad wing represented in Fig. 24b seems to be formed of the walls of the carpel rather than from an outgrowth of the epidermis. This is best shown in the face view (Fig. 24c); here the black represents the seeds, on the inner and upper sides of which appear the inflated empty portions of the carpels, then the broad marginal part of the carpel looking like a very wide wing. The reticulations of the carpel wall (not shown in the drawing) extend completely to the edges of the fruit. The fruit pictured in face view (Fig. 24c) was boiled before being drawn, while the one used for the cross-section (Fig. 24b) was not, which may explain the absence of the inflated portion in the cross-section.

While there is some tendency toward abortion of one or two mericarps in nearly all species, the tendency seems stronger in this species. A young fruit with one aborted mericarp is shown in Fig. 24a. *C. autumnalis* var. *bicarpellaris* Fenley in Jepson, Fl. Calif. 2: 436. 1936, appears to be based on one of the not uncommon individuals with two mericarps aborted.

#### KEYS FOR IDENTIFICATION IN LIMITED AREAS

##### CALLITRICHE IN THE GRAY'S MANUAL AREA

- a. Plants of various habit and leaf form (Plate 1168); leaf bases connected by a narrow membranous wing (Figs. 1a, 10g, 10w).
- b. Fruit 0.6–1.0 mm. wide; carpels wingless (Fig. 13a) or with wing at summit and narrowed or absent down the sides (Figs. 10a, 10d).
- c. Plants terrestrial, with essentially uniform broadly oblanceolate leaves (Fig. 3a); width of fruit exceeding the height by 0.2 mm. (Fig. 3b); anthers 0.1–0.2 mm. wide; stigmas 0.2–0.4 mm. long. . . . . *C. terrestris*.
- c. Plants aquatic or subterrestrial, of diverse habit and foliage; width of fruit less than, or equalling, or barely exceeding the height; anthers 0.3–1.5 mm. wide; stigmas 0.7 mm. or more long.
- d. Height of fruit exceeding the width by 0.1 mm. or less, or not at all; carpels wingless or with an obscure false wing (Figs. 4 & 5 on Plate 1167); reticulation on mericarps not running in vertical lines (Fig. 9 on Plate 1167).
- e. Foliage relatively coarse (Plate 1168); fruit widest above the middle (Figs. 13a, 13d, 13e, 13w); linear



- submersed leaves with tip of vein scarcely excurrent (Figs. 13h, 13s, 13An, 13Ao).....*C. heterophylla*.
- e. Foliage delicate (Figs. 1-9 on Plate 1169); fruit of equal width above and below the middle (Figs. 16b, 16f); linear submersed leaves with tip of vein slightly excurrent (Fig. 16e).....*C. anceps*.
- d. Height of fruit exceeding the width by 0.2 mm. (Plate 1172); carpels with a wing at summit that narrows and usually disappears down the sides (Figs. 1 & 2 on Plate 1167); reticulation on mericarps tending to run in vertical lines (Figs. 1 & 2 on Plate 1167).....*C. verna*.
- b. Fruit 1.2-1.7 mm. wide; wing equally broad all around the carpel (Figs. 23c, 23h).....*C. stagnalis*.
- a. Plants all aquatic with uniform linear-lanceolate leaves with bases not connected by a wing.....*C. hermaphroditica*.

## CALLITRICHE IN THE ROCKY MOUNTAIN AND PACIFIC STATES

- a. Plants of various habit and leaf form (Plate 1168); leaf bases connected by a narrow wing (Figs. 4a, 10g, 10w).
- b. Fruits pedicelled.
- c. Fruit wider than high.
- d. Leaves spatulate, the upper 0.8-2 mm. wide, 3-nerved (Fig. 4a); wing of carpels 0.1-0.2 mm. wide.....*C. marginata*.
- d. Leaves linear, 0.6 mm. or less wide, 1-nerved or with nearly obsolete lateral veins (Fig. 5a); wing of fruit nearly obsolete (Fig. 5a).....*C. sepulta*.
- c. Fruit higher than wide (Fig. 21b).....*C. longipedunculata*.
- b. Fruit sessile or nearly so.
- e. Carpels broadly winged all around the margin.
- f. Fruit about as wide as high.
- g. Fruit 1.0-1.2 mm. wide, at maturity nearly black, with sharply reticulate surface and white well-differentiated wings; groove between carpels shallow (Figs. 19a, 19b).....*C. trochlearis*.
- g. Fruit 1.2-1.7 mm. wide, at maturity nearly white, with obscurely reticulate surface grading almost imperceptibly into the wing; groove between carpels wide and deep (Figs. 23f, 23g).....*C. stagnalis*.
- f. Fruit higher than wide.....*C. longipedunculata*.
- e. Carpels wingless or winged at summit with the wing decreasing in width or absent on the sides.
- h. Length of fruit exceeding width by 0.2 mm. (Plate 1172); carpels winged at summit, the wing decreasing in width down the sides (Fig. 1 on Plate 1167); reticulations on mericarps tending to run in vertical rows (Figs. 1 & 2 on Plate 1167).....*C. verna*.
- h. Length of fruit almost equalling or slightly exceeding the width (Figs. 13a, 13d, 13Aa); carpels wingless or with an obscure false wing (Fig. 4 on Plate 1167); reticulations on mericarps not in vertical rows (Figs. 4, 5, 7, 8, 9 on Plate 1167).
- i. Foliage coarse (Plate 1168); fruit widest above the middle (Figs. 13a, 13Aa); linear submersed leaves with tip of vein scarcely excurrent (Figs. 13h, 13s, 13An, 13Ao).
- j. Fruit 0.7-0.8 mm. wide.....*C. heterophylla* var. *heterophylla*.
- j. Fruit 0.9-1.2 mm. wide.....*C. heterophylla* var. *Bolanderi*.



- i. Foliage delicate (Figs. 1-9 on Plate 1169); fruit of equal width above and below the middle (Figs. 16b, 16f); linear submersed leaves with tip of vein slightly excurrent (Fig. 16e).....*C. anceps*.
- a. Plants all aquatic with uniform linear-lanceolate leaves (Fig. 24j); leaf bases not connected by a wing.....*C. hermaphroditica*.

## CALLITRICHE IN THE SOUTHEASTERN UNITED STATES

- a. Plants terrestrial, with essentially uniform leaves; width of fruit exceeding the height by 0.2 mm.; anthers 0.1-0.2 mm. wide; stigmas 0.2-0.4 mm. long.
- b. Fruit sessile; margins of carpels not revolute.
- c. Fruit not gibbous at base (Fig. 3b).....*C. terrestris*.
- c. Fruit strongly gibbous at base (Fig. 7a).....*C. peploides*.
- b. Fruit pedicelled; margins of carpels thickened and revolute (Fig. 6a).....*C. Nuttallii*.
- a. Plants aquatic or subterrestrial, of diverse habit and foliage; width of fruit less than, or equalling, or barely exceeding the height; anthers 0.3-1.5 mm. wide; stigmas 0.7 mm. or more long.
- d. Foliage coarse (Plate 1168); fruit widest above the middle (Figs. 13a, 13m); linear submersed leaves with tip of vein scarcely excurrent (Figs. 13h, 13s, 13An, 13Ao).....*C. heterophylla*.
- d. Foliage delicate (Figs. 1-9 on Plate 1169); fruit of equal width above and below the middle (Figs. 16b, 16f); linear submersed leaves with tip of vein slightly excurrent (Fig. 16e).....*C. anceps*.

## CALLITRICHE IN MEXICO AND CENTRAL AMERICA

- a. Fruit gibbous at base.
- b. Base of each mericarp turned at nearly right angles to the face of the fruit (Fig. 7a); margins of carpels not winged.....*C. peploides* var. *peploides*.
- b. Base of each mericarp slightly twisted (Figs. 7b, 7d); margins of carpels winged.
- c. Margins of carpels thin, with an erect wing at summit (Fig. 7b).....*C. peploides* var. *semialata*.
- c. Margins of carpels thickened, with the wing turned outward (Fig. 7d).....*C. peploides* var. *media*.
- a. Fruit not gibbous at base.
- d. Plants terrestrial, with essentially uniform broadly oblanceolate leaves (Fig. 2a); width of fruit exceeding the height by 0.2 mm. (Fig. 2b); carpels narrowly winged around the margin; anthers 0.1-0.2 mm. wide; stigmas 0.2-0.4 mm. long.....*C. deflexa* var. *subsessilis*.
- d. Plants aquatic or subterrestrial, of diverse habit and foliage (Plate 1168); width of fruit about equalling the height (Figs. 13a, 13w); anthers 0.3-1.5 mm. wide; stigmas 1-6 mm. long.....*C. heterophylla*.

## CALLITRICHE IN SOUTH AMERICA

- a. Plants terrestrial, with uniform broadly oblanceolate leaves (Figs. 10 & 13 on Plate 1169); stem and leaves without stellate scales; stamens 0.2-1.2 mm. long and not elongating as the fruit develops; anthers 0.1-0.2 mm. wide; flowers without bracts.
- b. Width of fruit exceeding the height by 0.1 mm. (Fig. 1a); face of mericarps convex (Fig. 1b).....*C. turfosa*.